which a plurality of perforations **58** are formed that extend between laminate layers **12**, **14**. The film **60** may comprise, for example a viscoelastic rubber such as that identified by the trade name SMACTANE® available from SMAC in Toulon, France. The number and size of the perforations **58** will vary depending upon the particular application. The perforations **58**, which pass completely through the interlayer **16**, allow the migration of resin between the layers **12**, **14** which, when cured, form rigid connections between layers **12**, **14** that are surrounded by the VEM film matrix **60**. The direct connection between layers **12**, **14** provided by the resin that fills the perforations **58** reduces the possibility that laminate structure **10***f* may behave as a split laminate when the interlayer **16** is too soft.

The perforations **58** may be laid out randomly or in a uniform pattern across the interlayer **16**. The perforations **58** may have any of a variety of cross sectional geometries. For example, the cross sectional shape of the perforations **58** may be round as shown in FIG. **17***a*, elongate as shown in FIG. **17***b* or square as shown in FIG. **17***c*, or a combination of one or more of these or other geometries.

FIGS. **18** and **19** illustrate another embodiment of the composite laminate structure **10***g*, comprising a skin section **66**. The skin section **66** includes an interlayer **16** comprising a single layer VEM net **68** impregnated with a VEM resin **70**, generally similar to the laminate structure **10***a* in FIG. **2**. The glass transition temperature Tg of the VEM net **68** is higher than that of the VEM resin **70** so that, over the full operating range of the aircraft, the VEM net **68** provides adequate stiffness and the VEM resin **70** remains relatively soft. In this embodiment, the interlayer **16** is wholly surrounded by the layers **12**, **14** of laminate plies so as to be encapsulated, and therefore form a damping patch within the skin section **66**.

In the case of each of the laminate structures **10**-**10***g* described above, the interlayer **16** is assembled in a lay-up with the first and second layers **12**, **14**, and are co-cured using conventional techniques, such as vacuum bagging or autoclaving, so the interlayer **16** becomes co-cured to the first and second layers **16**, **18**, producing a consolidated laminated structure **10**-**10***g*.

Other variations of the damped laminate structures discussed above are possible. For example, as shown in FIG. **20**, the interlayer **16** containing VEM matrix material **43** may be reinforced by mixing relatively stiff material into the VEM material **43** This reinforcing material may be micro (meter) sized particles **77** of chopped carbon or ceramic micro-balloons. Also, the particles **77** can be nano (meter) sized using multi-walled and single-walled nano-tubes or nano-fibers. These particles **77** or inclusions may be mixed into the damping polymer when it is still in its aqueous phase (before being formed into a thin film.) The micro-meter sized particles **77** are much stiffer than the VEM **43** and when dispersed into the VEM **43**, the combination of the two materials (thru a Rule of Mixtures) is stiffer and stronger than the neat VEM **43**, i.e., a VEM **43** not containing any reinforcing materials. The nano-sized particles **77** function largely on the atomic level of the molecules, and help increase the strength of ionic bond between molecules which increases the strength of the bond between the VEM **43** and carbon epoxy layers **12**, **14**.

FIG. **21** illustrates an apparatus for forming a pre-preg of a fiber reinforced epoxy resin matrix **78** and a VEM film **74**. The VEM film **74** is fed from a continuous roll **76** along with a pre-preg **78** of a fiber reinforced epoxy resin material to a heating element **80**. The heating element **80** preheats the pre-preg **78** and film **74** which are then passed through consolidating rollers **82** that bond the film **74** to the pre-preg **78**. Release paper **84** is fed from a continuous roll **86** onto the surface of the pre-preg **78**, and the resulting, final pre-preg **88** is accumulated on a roll **90**.

Although the embodiments of this disclosure have been described with respect to certain exemplary embodiments, it is to be understood that the specific embodiments are for purposes of illustration and not limitation, as other variations will occur to those of skill in the art.

What is claimed is:

1. A damped composite laminate, comprising:

a first and a second layer comprising a carbon fiber and a resin;

a third layer disposed between the first and second layers, the third layer including damping material comprising a first viscoelastic material having a first glass transition temperature and a reinforcement medium comprising a second viscoelastic material having a second glass transition temperature greater than the first glass transition temperature, the reinforcement medium comprising fiber material, the materials in the third layer different than the resin in the first and second layers; and,

a first barrier layer disposed between and contacting the first layer and the third layer, and a second barrier layer disposed between and contacting the second layer and the third layer, said first and second barrier layers being formed of a fabric of at least 0.0005 inch thick, the first barrier layer and the second barrier layer configured to substantially prevent intermixing of material comprising said first and second layers with material comprising said third layer.

2. The damped composite laminate of claim **1**, wherein all sides of the third layer are surrounded by the first and second layers.

3. The damped composite laminate of claim **1**, wherein the first layer and the second layer are characterized by a plane of orientation, and wherein the reinforcement medium includes fibers embedded in the viscoelastic material, the fibers positioned substantially in the same plane.

4. The damped composite laminate of claim **3**, wherein the fibers are co-cured to the first and second layers.

5. The damped composite laminate of claim **1**, wherein the first layer and the second layer are characterized by a plane of orientation, and wherein the fibers have a length extending a direction generally transverse to the plane of the first and second layers.

6. The damped composite laminate of claim **5**, wherein the fibers are Z-fibers.

7. The damped composite laminate of claim **1**, wherein:

the damping material includes a first viscoelastic material having a first glass transition temperature, and

the reinforcement medium includes fibers impregnated with a second viscoelastic material having a second glass transition temperature greater than the first glass transition temperature.

8. The damped composite laminate of claim **1**, wherein:

the damping material includes a first viscoelastic material having a first glass transition temperature, and

the reinforcement medium includes an open weave of a second viscoelastic material embedded within the first viscoelastic material, the glass transition temperature of the second viscoelastic material being greater than the glass transition temperature of the first viscoelastic material.